BOTTOMLESS SPAR-TYPE OIL STORAGE TANK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a bottomless spar-type oil storage tank. More specifically, the present invention relates to attached facilities provided to various marine structures such as drill ships and crude oil storage and transportation facilities.

2. Description of the Related Art

Conventionally, a spar-type tank with a bottom is used as an oil storage tank for a marine structure. The big load of this conventional oil storage tank with the bottom is problematic. In addition, much efforts and expenses are required to repair and keep its bottom. That is because there is a difference in buoyancy according to the amount of oil filling in the tank having the fixed bottom; and an extra buoyancy control system is not included in the tank. Moreover, a person must enter the tank in the seabed far from the land in order to clean and repair its bottom, which is very difficult and dangerous.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate an embodiment of the invention, and, together with the description, serve to explain the principles of the invention:

FIG. 1 is a front view depicting the structure and operation of a bottomless spar-type oil storage tank according to the present invention;

FIG. 2 is a plan view of the oil storage tank as taken along line A of FIG. 1 in case of being bottomless;

FIG. 3 is a plan view of the oil storage tank as taken along line A of FIG. 1 in case of having a pliable film;

FIG. 4 is a plan view of the oil storage tank as taken along line A of FIG. 1 in case of having an upward/downward-moving bottom; and

FIG. 5 is a schematic view depicting the upward/downward-moving bottom.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a bottomless spar-type oil storage tank that has no bottom, or has a pliable film or an upward/ downward-moving bottom, breaking from a conventional spar-type oil storage tank with a bottom, and is of dual-wall structure with inner and outer vessels to apply a buoyancy between two vessels and compensate for the loss of buoyancy due to its bottomless structure.

In order to achieve the above object, the present invention provides a bottomless spar-type oil storage tank including a structure of a bottomless spar, and a buoy and dual walls for solving buoyancy and ballasting problem.

According to another aspect of the present invention, a bottomless spar-type oil storage tank includes a structure of a bottomless spar, a buoy and dual walls for solving a buoyancy and ballasting problem, and a pliable film for preventing oil in the tank and sea water from adhering to each other.

According to still another aspect of the present invention, a bottomless spar-type oil storage tank includes a structure of a bottomless spar, a buoy and dual walls for solving a buoyancy and ballasting problem, and an upward/ downward-moving rigid bottom for preventing oil in the tank and sea water from adhering to each other.

The above spar includes an inner vessel and an outer vessel which are spar-type coupled to each other, an oil storage chamber formed in the inner vessel, a permanent ballast tank provided in the lower portion between the inner and outer vessels, and permanently holding pieces of iron, orecrete, concrete, sludge, etc., a sea water ballast tank provided on a separating panel, and an air buoyancy tank provided on the tank.

The pliable film is made of polyester or a highly-polymerized material through which a fluid cannot pass. The pliable film does not have influence on the operating performance of the tank.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following detailed description, only the preferred embodiment of the invention has been shown and described, simply by way of illustrating the best mode contemplated by the inventor(s) of carrying out the invention. As will be realized, the invention is capable of modification in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not restrictive.

Referring to FIG. 1, the inventive oil storage tank is of dual-wall structure to compensate for the loss of buoyancy due to its bottomless structure, thus solving the ballasting and buoyancy problems. FIGS. 2, 3 and 4 are each plan views of a bottomless oil storage tank,

an oil storage tank with a pliable film, an oil storage tank having an upward/downward-moving rigid bottom, which shows a buoy attached to the bottomless spar. When certain waves are introduced to the tank, a great wave may be generated between the water and the oil in the tank. Since this great wave may induce marine pollution, it is necessary to control the spar's water drawn and a draft of a material held in the tank through ballasting.

In an oil storage tank installed on the seabed under a marine structure having a working tower 1, an incinerating tower 2, a heliport 3, an oil separator 4, a drilling deck 5, a production deck 6, and a bottom deck 7, its inner vessel 10 and outer vessel 11 are spar-type coupled to each other. An oil storage chamber 12 is formed in the inner vessel 10, and in the lower portion between the inner and outer vessels 10 and 11 is provided a permanent ballast tank 13 in which pieces of iron, orecrete, concrete, sludge, etc. fill. A seawater ballast tank 15 is provided on a separating panel 14, and an air buoyancy tank 16 is provided on the tank 15 in such a manner that the overall tank acts as a buoy. Under the permanent ballast tank 13 is provided a riser 31 through which crude oil in the seabed is conveyed to the oil storage tank. The oil storage chamber 12 is bottomless. The tank is connected to a submarine anchor by way of mooring lines 17 and is riding at its moorings.

When certain waves are introduced to the inventive oil storage tank, great waves may be generated between water and the oil in the tank. The generation of great waves that may cause marine pollution, can be compensated by controlling the spar's water drawn and a draft of a material held in the tank through ballasting.

As depicted in FIG. 3, since a pliable film 20 is made of polyester or a highly-polymerized material through which a fluid cannot pass, and is secured to the inner vessel 10

by way of a hook or other simple device like a tent, the inner oil cannot flow out. The pliable film 20 is light in weight, and can prevent the inner oil and water from adhering to each other and falling off. A rigid bottom 30 of FIG. 4 is provided to be moved up and down. This bottom 30 automatically elevates in the inner vessel 10 by a pressure difference between the seawater and oil. The bottom 30 smoothly elevates by a rail member 32.

Such an elevating mechanism employs a well-known elevator or lift member, and the detailed description about it is omitted. Since its operating system and the incoming and outgoing mechanism of the oil inside the tank are also well known, the detailed description about it is also omitted.

The rigid bottom 30 is automatically moved to a position to which the smallest force is applied by the pressure difference between the surrounding seawater and oil held in the tank, without any power plant. Therefore, the force generated by waves is not transferred to the oil storage tank.

As described above, the inventive oil storage tank can enhance the operating performance and reduce the costs for keeping and repairing, without damage to the function of the original spar by removing its bottom.

While this invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.